



AL- MUSTAQBAL UNIVERSITY COLLEGE

Medical physics

first year

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FORCES ON AND IN THE BODY



Forces in the body:

- Gravitational force
- Electrical force
- Nuclear force

Forces on the body:

- Static force
- Dynamic force
- frictional force

A: FORCES IN THE BODY

1.Gravitational force G.F:

This law state that “there is a force of attraction between any two objects”

e.g(our weight is due to attraction between earth and our bodies).

Effect of G.F:

A – formation of varicose veins in leg

B – the loss of some bone minerals when a person become weightless such as in an orbiting satellite

C – long-term bed rest removes much of the force of body weight from the bones can lead to a serious bone loss.

- Gravitation force $F = mg$ Where F is the force of gravity m is the mass
 - g is the acceleration due
 - to the gravity
-

2. ELECTRIC FORCES E.F:

The forces produced by the muscles are caused by electrical charges attracting or repelling other electrical charges.

E.F between e- and p- H_2 atoms (10^{39}) time greater than G.F

There are two types of E.F :

A – static force :(either attractive or repulsive → each of billions of living cells in the body has electrical potential difference across cell membrane)

B – magnetic force :(produced by moving electrical charge in muscle and nerves).

3. NUCLEAR FORCE N.F

A – strong nuclear force : is much larger than the other → it acts as the “glue” to hold the nucleus together against the repulsive force produced by the protons on each other

B – weaker nuclear force : is involved with electron (beta) decay from the nucleus

B: FORCES ON THE BODY

1- static forces :

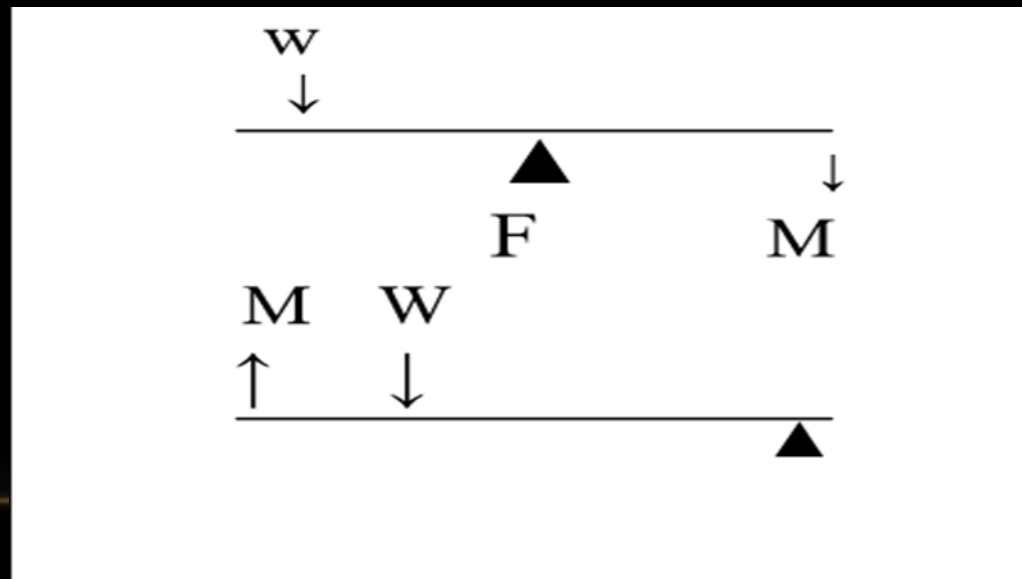
When object are stationary (static) they are of equilibrium means sum of force in any direction is equal to zero and the sum of the torques about axis also equal zero .

Torque The sum of the torque's about any axis is equals to zero .

Torque = force x length

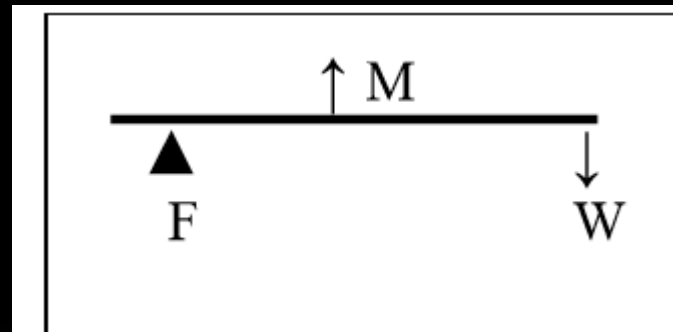
The sum of the torque's about any axis is equals to zero .

- Man of muscle and bone system of the body acts as levers which are classified to
- A - First class lever : the force at the fulcrum point (F) between the muscle force (M) and the weight (W) (e : g : the head)



B – Second class level : W between F and M
(e . g : standing on toes)

c – Third class levers : M between F and W (e . g : the elbow joint of the arm)



DYNAMIC FORCE

The force on the body under the constant acceleration or deceleration of one dimensional motion .

The newton's second law force equal mass times acceleration can be written as:-

$$F=ma$$

F: the force (N, dyne)

m : the mass (Kg, g)

a : acceleration (cm/sec^2 or m/sec^2)

THE CENTRIFUGE

Is way to increase apparent weight, it is especially useful for separating in a liquid , the centrifuge works using the sedimentation principle . It speed up the sedimentation that occur at a slow rate under the force of gravity .

In a laboratory centrifuge that uses sample tubes ,the radial acceleration causes denser particles to settle to the bottom of the tube , while low density substances rise to the top.

